31. (New) The user station according to claim 27, further comprising:

a connection quality arrangement for measuring in parallel a connection quality of an existing connection between the user station and the additional user station;

wherein the channel assignment arrangement performs a channel change if the connection quality falls below a preselected value, so that at least one new transmission channel is assigned as a function of a channel measurement of the existing connection, and the channel measurement arrangement performs the channel measurement during the existing connection.

32. (New) The user station according to claim 27, wherein the following occurs if a transmission capacity of the transmission channels established for assignment is not sufficient:

the channel assignment arrangement assigns at least one transmission channel scrambled using a new scrambling code, for transmitting signals between one of the base stations and one of the mobile stations as a function of the channel measurement by the channel measurement arrangement; and

the channel measurement arrangement performs the channel measurement by measuring the transmission power on all possible ones of the transmission channels after scrambling the at least one transmission channel using the new scrambling code, if a transmission power measured on the at least one transmission channel is minimal.

Remarks

This Preliminary Amendment cancels without prejudice original claims 1 to15 in the underlying PCT Application No. PCT/DE00/03912, and adds without prejudice new claims 16 to 32. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.121(b)(3), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules, to correct informalities, and to incorporate the changes reflected in the substitute specification pages 1 and 1a of the annex of the International Preliminary Examination Report. As required by 37 C.F.R. § 1.121(b)(3)(iii) and § 1.125(b)(2), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. In the Marked Up Version, underlining indicates added text and bracketing indicated deleted text. Approval and entry of the Substitute Specification (including Abstract) is respectfully requested.

The underlying PCT Application No. PCT/DE00/03912 includes an International Search Report, dated April 9, 2001. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.

The underlying PCT application also includes an International Preliminary Examination Report, dated April 29, 2002, and an annex (including substitute specification pages 1 and 1a). An English translation of the International Preliminary Examination Report and the annex accompanies this Preliminary Amendment.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,
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By: Reg No 35,952

Dated: November 10, 2003

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METHOD OF ASSIGNING TRANSMISSION CHANNELS IN A TELECOMMUNICATIONS NETWORK AND USER STATION

[Background Information]

FIELD OF THE INVENTION

The present invention relates to a method of assigning transmission channels in a telecommunications network and to a user station [according to the definition of the species in the independent claims.].

BACKGROUND INFORMATION

A method and a device for operation in an indoor CDMR telecommunications system are referred to in European Published Patent Application No. 0 865 172, in which two or more wireless communications systems are operated superimposed. One of the two systems is an indoor system and the other is an outdoor system. The indoor system monitors the operation of the outdoor system and detects which part of the available radio resources are sometimes not used or are interference-free in the outdoor system. The indoor system dynamically selects an unused outdoor channel for indoor operation. The indoor radio traffic is divided into TDD time slots, which include the time slots for monitoring the existing radio connections on other outdoor channels, so that rapid changes are possible in accordance with changing traffic and changing interference conditions. A threshold value comparison is performed during the selection of the channels.

In mobile radio systems of the third generation, for example in accordance with the GSM standard (Global System for Mobile Communications) or the UMTS standard (Universal Mobile Telecommunication System) or the like, two concepts [or modes are] (or modes) may be provided for transmitting signals via an air interface between a base station and a mobile station, depending on the transmission resource used. If various

frequency bands are provided as a transmission resource, an FDD mode (Frequency Division Duplex) [is] may be used, in which two different frequency bands are used to transmit the signals [for the uplink transmission direction] from the mobile station to the base station [and for] in the [downlink] uplink transmission direction and from the base station to the mobile station in the downlink transmission direction. If time slots are used as a transmission resource, the TDD mode (Time Division Duplex) [is] may be used, in which different time slots are used for the uplink transmission direction and the downlink transmission direction, while using the same frequency band. Further channel separation is possible for both modes in this case [by using a CDMA method (Code Division Multiple Access). The transmission channels for connections between one or more base stations and various mobile stations may be separated from one another by different codes, with the same transmission resource being used, for example, the same time slot and/or the same frequency position. In both modes, the code assignment for the transmission channels to be set up is coordinated by the mobile wireless network, so that no code is used multiple times].

However, in uncoordinated operation the base stations [are] may not be linked via a higher-order system, so that coordinated code assignment [is] may not be possible. Such operation [is] may be advisable, for example, [advisable] for the home sector with cordless telephones, in which, under certain circumstances, many individual base stations may be operated independently from one another. In this case, the code assignment may [no longer] not be coordinated. Therefore, only one [single] base station may be active per transmission resource, [i.e.,] for example, per time slot or per frequency band, but [possibly] even using multiple different codes for this purpose. This transmission resource [is] may be occupied for a neighboring base station, since [it does] the station may not know the codes used [there. The occupation of the

transmission resource may be detected in this case by]. A power measurement may permit the neighboring base station [through a power measurement. The] to detect whether a transmission resource is occupied. If so, the neighboring base station may [then accordingly] substitute other transmission resources, [i.e.,] for example, other time slots or frequency bands.

[Advantages of the Invention]

SUMMARY OF THE INVENTION

[The] It is believed that an exemplary method according to the present invention for assigning transmission channels in a telecommunications network and [the] an exemplary user station according to the present invention [having the features of the independent claims] may have the advantage in [contrast to the related art] that, in uncoordinated operation of [the] base stations, at least one of the transmission channels is assigned for transmitting signals between one of the base stations and one of the mobile stations as a function of a channel measurement[, in which]. To perform the channel measurement, the transmission power on all possible transmission channels is measured, if the previously measured transmission power on [this] the transmission channel is minimal. In this [way, the capability is provided of distributing] manner, the existing transmission channels may be optimally distributed on [the] connections set up or to be set up for transmitting signals between the base stations and the mobile stations, so that the capacity of the telecommunications network, and therefore the number of connections to be set up simultaneously [in the telecommunications network], may be increased, or [even] at least maximized. [One and the] The same transmission channel may even be used simultaneously by various base stations [when] if, for example, due to a limited range, [they] the various base stations influence one another insignificantly or not at all.

[Advantageous refinements and improvements of the method of assigning transmission channels in a telecommunications network and the user station according to the independent claims are possible through the measures described in the subclaims.

It is particularly] It may be advantageous that codes are provided, through which at least one transmission resource, [particularly] for example, a time slot or a frequency band, is spread using multiple transmission channels for transmitting signals between the base stations and the mobile station, and that the channel measurement includes a code measurement, in which a received signal for each transmission resource is despread using each allowed code [in order] to measure the transmission power [in] of each of the transmission channels. In this [way, the capability is provided of] manner, a transmission resource, for example, a time slot or a frequency band, [being] may be used jointly and simultaneously by different base stations[. A transmission resource, for example a time slot or a frequency band, may be used jointly simultaneously] and/or by multiple transmission channels [in this way]. Through [this] the division of the transmission resources, the capacity of the telecommunications network, and therefore the number of connections [to be] capable of being set up simultaneously [in the telecommunications network, are also], may be increased.

It is believed to be advantageous in [this case] that the channel measurement for the assignment of at least one of the transmission channels between one of the base stations and one of the mobile stations is [carried out when] performed while a connection is being established. In this [way] manner, the capacity of the telecommunications network is used at the earliest possible time for every connection to be set up.

It is [particularly] also believed to be advantageous that the channel measurement for the assignment of at least one of the transmission channels is [carried out] performed during an existing connection between one of the base stations and one of the mobile stations, that the connection quality of the existing connection is measured in parallel, and, if the connection quality falls below a preselected value, that a channel change is [carried out] performed and at least one new transmission channel is assigned as a function of the channel measurement of the existing connection. In this [way] manner, dynamic channel assignment may be implemented for one or more existing connections, so that [all of] the transmission channels [just] previously assigned to an existing connection have the highest possible connection quality.

In addition, it is believed to be advantageous that, for at least one of the base stations, specific information is transmitted via a broadcast channel to all [of the] mobile stations [lying] in the reception range of [this] the at least one base station, and that the broadcast channel is changed if the interference detected thereon exceeds a preselected value. In this [way, dynamic assignment of] manner, the broadcast channel may be dynamically assigned to at least one of the base stations [is possible], the broadcast channel [just] previously used [having] receiving as little interference as possible.

[A] It is believed that a further advantage is that at least one of the transmission channels is reserved for use as a broadcast channel. In this [way] manner, the expense and [the] time required for the mobile stations [for finding] to find the broadcast channel is reduced, since [they] the stations may find the broadcast channel from an already selected or preselected set of transmission channels.

It is [particularly] also believed to be advantageous in that, [for the case in which] if the transmission capacity of the established transmission channels [established thus far for assignment is not sufficient] is insufficient, at least one transmission channel scrambled using a new scrambling code is assigned for transmitting signals between one of the base stations and one of the mobile stations as a function of a channel measurement, in which the transmission power on all possible transmission channels is measured after scrambling, using a scrambling code, if the transmission power measured on [this] the scrambled transmission channel is minimal. In this [way, situations are] manner, it may be avoided [in which] that a base station in uncoordinated operation [no longer finds any] cannot find a free transmission [channels] channel because, for example, one or more other base stations already occupy all of the transmission channels. Rather, the number of transmission channels and therefore the data rate may be further increased [even further] by using scrambling codes.

[Drawing]

BRIEF DESCRIPTION OF THE DRAWINGS

[Exemplary embodiments of the present invention are illustrated in the drawing and explained in more detail in the following description. Figure 1 shows a block diagram of a] Figure 1 is a block diagram of an exemplary user station according to the present invention[,].

Figure 2 [shows] is a code-time slot diagram[,].

Figure 3 [shows a]is a diagram showing an exemplary first arrangement of base and mobile stations in a mobile radio network[, and Figure 4 shows a] according to the present invention.

Figure 4 is a diagram showing an exemplary second arrangement of base and mobile stations in a mobile radio network according to the present invention.

[Description of the Exemplary Embodiments]

DETAILED DESCRIPTION

In Figure 1, 15 identifies a user station of a telecommunications network 5. Telecommunications network 5 may be implemented, for example, [be implemented] as a landline network or as a mobile radio network. If telecommunications network 5 is [implemented as] a mobile radio network, [then] user station 15 may [be] include a base station 11, 12 or a mobile station 21, 22 [of telecommunications network 5 shown in Figure 3. In the following, it is assumed], as shown, for example, in Figure 3. For the description to follow, it is presumed, for exemplary purposes only, that telecommunications network 5 is [implemented as] a mobile radio network and that user station 15 is [implemented as] a base station 11, 12 or [as] a mobile station 21, 22. Mobile radio system 5 and user station 15 may be implemented, for example, [be implemented in this case] according to the GSM standard (Global System for Mobile Communication), [according to] the UMTS standard (Universal Mobile Telecommunication System)[,] or the like.

User station 15 illustrated in Figure 1 includes a receiver 25, to which a receiving aerial 60 is connected. As shown in Figure 1, user station 15 also includes a transmitter 35, to which a transmitting aerial 70 is connected. Receiving aerial 60 and transmitting aerial 70 may also be combined into a combined transmitting/receiving aerial by using a multiplexer, for example. [On the one hand, receiver] Receiver 25 is connected on the output side to an input of [means] code measurement arrangement 30 for code measurement and[, on the other hand, it is] is also connected to an input of a despreading device 45. Codes of a first code memory 51 are[, in addition,] also supplied to [means] code measurement

arrangement 30 for code measurement. [At] In addition, at least one code of a second code memory 52 is[, in addition,] supplied to despreading device 45. [Means] Code measurement arrangement 30 for code measurement [are] is connected on the output side to an input of [means] channel measurement arrangement 10 for channel measurement. Despreading device 45 is connected on the output side to an input of [means] a connection quality arrangement 40 for measuring the connection quality. An output of [means 40 for measuring the] connection quality arrangement 40 is[, in addition,] also supplied to [means 10 for] channel measurement[. Means 10 for channel] arrangement 10. Channel measurement [are] arrangement 10 is connected on the output side to an input of [means] a channel assignment arrangement 20 for channel assignment, [whose] the output of which is supplied to transmitter 35.

In the following[, it is to be assumed that] description, for exemplary purposes only, both [a] first base station 11 and [a] second base station 12 in mobile radio network 5 as shown in Figure 3 [have] are constructed similarly to the [construction of] user station 15 shown in Figure 1[. It is also to be assumed that], and both first mobile station 21 and second mobile station 22 [have the construction of] are constructed similarly to user station 15 shown in Figure 1. As shown in Figure 3, first base station 11 covers a first radio cell 61, in which [it may reach] the first base station 11 may communicate with mobile stations using radio signals. Second base station 12 covers a second radio cell 62, in which [it may reach] the second base station 11 may communicate with mobile stations using its radio signals. First mobile station 21 is positioned in first radio cell 61, while[, in contrast,] second mobile station 22 is positioned in second radio cell 62. A first connection 41 is to be established between first base station 11 and first mobile station 21, while[, in contrast,] a second connection 42 is to be established between second base station 12 and second mobile station 22.

Two different concepts [or modes] (or modes) may be provided for first connection 41 and for second connection 42[. On the one hand, there is the]: FDD mode (Frequency Division Duplex), in which two different frequency bands are used as a transmission resource for the uplink transmission direction from respective mobile stations 21, 22 to assigned base stations 11, 12[. On the other hand, there is the]; and TDD mode (Time Division Duplex), in which different time slots in the same frequency band are used as a transmission resource for the uplink transmission direction and the downlink transmission direction. In both modes, the respective transmission resources [used] may be spread into multiple transmission channels [in each case] by using codes C[. The use of such codes is] based [in this case], for example, on [the principles of] a CDMA method (Code Division Multiple Access) for further channel separation. In this case, one frequency band or one time slot may each be spread [out] into multiple transmission channels by using different codes. One such transmission resource, for example, one time slot or one frequency band, may be used simultaneously by various connections and/or by [one and] the same connection in the uplink or in the downlink transmission direction by using different codes, so that the capacity of mobile radio network 5 and/or the number of connections which may be set up in mobile radio network 5 [is] may be increased by increasing the number of usable transmission channels. [Using the] If, for example [of], the transmission resources are implemented as time slot ZS, spreading [out] into multiple transmission channels by using different codes C is illustrated [using] in Figure 2. [It is to be assumed in] In this case [that], fifteen time slots are provided per transmission frame[, which are provided] on the abscissa numbered from 0 to 14 in Figure 2. Four different codes C from 1 to 4 are [then] plotted on the ordinate, so that each time slot ZS is spread into four different transmission channels, which differ from one another due to different coding, using the same spread factor 4. The

transmission channel's [arising] created in this [way may be] manner are illustrated as raster elements in the code-time slot diagram shown in Figure 2 and are indicated, as a whole, using reference number 1.

[In the following] For example, time slots for transmitting signals in mobile radio network 5 [are to] may be used as [an example of] a transmission resource. [Base] In this case, base stations 11, 12 are [to be] operated uncoordinatedly and are not [to be] connected via a higher order system, so that coordinated code assignment [is] may not be possible. Such uncoordinated operation [is, for example, also advisable] may be used for the home sector when using mobile stations 21, 22 implemented as cordless telephones, since [in this case] many individual base stations [are] may be, under certain circumstances, operated independently from one another and therefore uncoordinatedly. For [the application of] a cordless telephony application, telecommunications network 5, base stations 11, 12, and mobile stations 21, 22 may be implemented, for example, [be implemented] in accordance with the DECT standard (Digital European Cordless Telecommunications). In such uncoordinated operation, coordinated code assignment for the individual connections to be set up between base stations 11, 12 and mobile stations 21, 22 [is no longer possible in a coordinated way.] may no longer be possible.

[In the following] Below, first connection 41 to be set up between first base station 11 and first mobile station 21 [will be] is described for exemplary purposes only. While the connection is being established, [it is checked by means 30 for] code measurement arrangement 30 checks, either in first base station 11 or in first mobile station 21, which codes C in which time slots ZS are already occupied by other connections. For this purpose, the signal for each of fifteen time slots ZS received in first base station 11 and/or first

mobile station 21 [must] should be despread using each permitted code C stored in first code memory 51, [which corresponds to]corresponding to CDMA demodulation [in the CDMA method]. Through despreading in [means 30 for] code measurement arrangement 30, all transmission channels 1, each of which are [each] implemented as a code/time slot combination, are extracted from the received signal [in this way]. As shown in Figure 2, [there are] sixty transmission channels [in this case, which] result from the multiplication of fifteen time slots ZS by four codes C. [Transmission] Extracted transmission channels 1 [extracted in this way] are then supplied to [means 10 for] channel measurement arrangement 10, which measures the transmission power on all extracted transmission channels 1. First connection 41 to be set up is then assigned to at least one of transmission channels 1 by [means 20 for] channel assignment arrangement 20. In this case, the transmission channel [whose] with a minimal previously measured transmission power is [minimal is] assigned to first connection [1] 41. For a full duplex connection to be set up between first base station 11 and first mobile station 21, the [method described is to be carried out] exemplary method according to the present invention is to be performed both for the uplink transmission direction from first mobile station 21 to first base station 11 and for the downlink transmission direction from first base station 11 to first mobile station 21, so that at least one transmission channel may be used for first connection 41 in each of the two transmission directions. [In] Figure 3[,] illustrates the downlink transmission direction [is illustrated by the arrow] with arrows for both first connection 41 and for second connection 42. [In the following, first connection 41 is considered again.] In this case, the channel measurement for assigning at least one of transmission channels 1 may be [carried out] performed in the uplink transmission direction by first base station 11 and the channel measurement for assigning at least one of transmission

channels 1 may be [carried out] performed in the downlink transmission direction by first mobile station 21. The assignment of the at least one of transmission channels 1 selected through the channel measurement in the uplink transmission direction may then be [carried out] performed by first base station 11. The assignment is performed [in this case] by its [means 20 for] channel assignment arrangement 20, which, via transmitter 35 of first base station 11, transmits a corresponding signal to first mobile station 21 in regard to the at least one assigned transmission channel [to first mobile station 21]. In a corresponding [way] manner, the assignment of at least one of transmission channels 1 in the downlink transmission direction may be [carried out] performed by first mobile station 21, [whose means 20 for] the channel assignment [transmit] arrangement 20 of which transmits a signal [via corresponding transmitter 35] to first base station 11 [in this case, in order to make] via corresponding transmitter 35 so that first base station 11 may know the at least one transmission channel selected for the downlink transmission direction [known in first base station 11].

According to [the] this exemplary embodiment [described here, in this case] of the present invention, a first transmission channel 31, which represents a combination of the third time slot and the second code shown in the code/time slot diagram [in] of Figure 2, is assigned for the downlink transmission direction of first connection 41.

Before establishing first connection 41, first base station 11 initially selects one of transmission channels 1 and uses it as a broadcast channel. According to [the] this exemplary embodiment [described here, first] of the present invention, base station 1 first selects a combination of first time slot and third code, as shown in the code/time slot diagram [in] of Figure 2, as broadcast channel 50. The specific information for first base station 11 is transmitted via broadcast channel

50 to all mobile stations located in first radio cell 61. This specific information [contains] may contain, for example, the codes used by first base station 11, an identification of first base station 11, synchronization information, information about transmission channels and/or code/time slot combinations already used, information about paging messages [which] that exist for one or more of the mobile stations located in first radio cell 61, etc. First mobile station 21 located in first radio cell 61 may therefore [recognizes] recognize first base station 11 assigned to it by synchronization on broadcast channel 50 and analysis of the information transmitted via this broadcast channel 50.

[In principle, each] Each of transmission channels 1 may be used as broadcast channel 50. [In order to] To avoid interference of the broadcast channels of different base stations 11, 12, [there is the possibility of changing] the broadcast channel [if needed. In this case, it may be provided that] may be changed if needed, for example, if interference from other broadcast channels or transmission channels detected on the broadcast channel [is changed if the interference detected on it due to other broadcast channels or other transmission channels] exceeds a preselected value. [In order that] To reduce the outlay of first mobile station 21 [described in this example is reduced while finding] and to find broadcast channel 50, either a special code C may be reserved and/or preselected for any desired time slot ZS or a specific time slot ZS may be reserved and/or preselected for any desired code C for the broadcast channel of first base station 11[. A], or a prereserved selection of any desired specified transmission channels and/or code/time slot combinations [for use] may be used as a broadcast channel 50 [suggests itself as a third possibility].

During existing first connection 41, the transmission power is cyclically remeasured [in the way described] on all possible

transmission channels 1, so that a picture of free and occupied and/or of malfunctioning and functioning transmission channels is continuously available. In parallel [to this], the connection quality of existing first connection 41 is measured by [means 40 for measuring the] connection quality arrangement 40 in first base station 11 and/or in first mobile station 21, for example, on the basis of the transmission error rate. If the connection quality falls below a preselected value, a channel change to another transmission channel and/or another code/time slot combination [is then carried out] may be performed. For this purpose, the transmission powers of the transmission channels and/or code/time slot combinations previously not used for first connection 41 [must] should be continuously monitored[, as described]. For the channel change, [in this case] first base station 11 measures the connection quality of first connection 41 in the uplink transmission direction and first mobile station 21 measures the corresponding connection quality of first connection 41 in the downlink transmission direction. If the connection quality falls below a preselected threshold, the channel changes in the uplink and downlink transmission directions occur independently from one another. For this purpose, [three concepts are possible, as for] the establishment of the connection[. In a first concept] may be accomplished in three manners. In the first manner, the channel change is performed solely by base station 11, since it already knows all of the transmission channels it uses. For this purpose, first mobile station 21 transmits, via its transmitter 35, the measurement results of the connection quality or the request for a channel change due to such measurement results for the downlink transmission direction to first base station 11. In the second [concept, first] manner, mobile station 21 first initiates the channel change in the downlink transmission direction and first base station 11 initiates the channel change in the uplink transmission direction. The third [concept] manner is oriented to the DECT standard, in which the channel change is

initiated by first mobile station 21 both in the uplink and in the downlink transmission directions, and first base station 11 merely signals to first mobile station 21 that a channel change is necessary in the uplink transmission direction. Regardless of whether the connection quality is measured in first base station 11 or in first mobile station 21, this measurement is performed in that the transmission channels to be evaluated for first connection 41 are extracted from the signal received via corresponding receiver 25 by respective despreading device 45 with the aid of the code(s) assigned to first connection 41, which is/are stored in second code memory 52, and supplied to [means 40 for measuring the] connection quality arrangement 40. In connection quality[. In means] arrangement 40 [for measuring the connection quality], the connection quality of the transmission channels for first connection 41 [is] may then be, for example, measured on the basis of the transmission error rate. In parallel [to this, means 30 for], code measurement [extract] arrangement 30 extracts all transmission channels 1 from the signal received via receiver 25 with the aid of the codes stored in first code memory 51 and [supply] supplies these transmission channels to the channel measurement in first [means 10 for] channel measurement arrangement 10, which [measure] measures the transmission power on extracted transmission channels 1. [Means 10 for channel] Channel measurement [now check] arrangement 10 checks, with reference to the value of the connection quality of the respective transmission channel of first connection 41 determined by [means 40 for measuring the] connection quality arrangement 40, whether this value falls below a preselected value for the connection quality. If [this is the case, means 10 for] so, channel measurement [select] arrangement 10 selects the transmission channel [which] that has the minimum transmission power and [cause means 20 for] causes channel assignment arrangement 20 to subsequently use this transmission channel for first connection 41 instead of the corresponding transmission channel measured by [means 40

for measuring the] connection quality arrangement 40, which has too low a connection quality.

[In Figure 3, a scenario is illustrated in which] Figure 3 illustrates first base station 11 and second base station 12 [are] operated independently from one another. One mobile station 21, 22 is registered in each of two base stations 11, 12. First mobile station 21 is initially located at a first position A within first radio cell 61, illustrated in Figure 3, and has a first transmission/reception range 71. Second mobile station 22 is located at a third position C in second radio cell 62 and includes a second transmission/reception range 72. First mobile station 21 may transmit and receive radio signals within first transmission/reception range 71 [in this case]. Signals transmitted outside [this] the first transmission/reception range 71 may no longer be received by first mobile station 21. In addition, signals transmitted by first mobile station 21 outside first transmission/reception range 71 may no longer be received in second base station 12 and in second mobile station 22. The [corresponding] same is true for second transmission/reception range 72 of second mobile station 22. In this case, the same transmission channels and/or code/time slot combinations are simultaneously used in the uplink and in the downlink transmission directions for both first connection 41 and second connection 42. As shown in [Figure] Figures 2 and [Figure] 3, first transmission channel 31 is used for the downlink transmission direction for both first connection 41 and second connection 42 [in this case. The case of the]. If a channel change [described in the following] occurs, it applies for both the uplink and the downlink transmission directions, both being independent from one another. Both mobile stations 21, 22 are sufficiently distant from one another so that their transmission/reception ranges 71, 72 do not overlap and do not mutually interfere in their transmission channels. The instantaneous transmission quality is measured for both connections 41, 42 in the [way]

manner described above, both in the uplink and in the downlink transmission directions, for example, by analyzing the transmission or bit error rates. Both mobile stations 21, 22 cyclically establish the transmission power of all possible transmission channels 1 and/or code/time slot combinations, by despreading all transmission channels 1 and/or code/time slot combinations in the way described [through means 30 for] above via code measurement arrangement 30 and establishing the transmission power on transmission channels 1 extracted in this way [through means 10 for] via channel measurement arrangement 10 and storing this transmission power in tabular form in a memory [not illustrated] (not shown in Figure 1). Smaller values of the transmission power measured signal little or no interference in this case. If first mobile station 21 now moves from first position A into second position B and therefore, as shown in Figure 3, into second radio cell 62 and/or into second transmission/reception range 72 of second mobile station 22, the mutual interference of the transmission channels used increases and the connection quality is therefore reduced. If it falls below the preselected value for the connection quality, then a channel change is initiated in the way described above for at least one of the two connections 41, 42 and this connection is assigned at least one new transmission channel in the uplink and/or in the downlink transmission direction.

In a modification of the exemplary embodiment described with reference to Figure 2, despreading individual time slots ZS by more or less than four codes C may also be provided.

According to [the] this exemplary embodiment [described here] of the present invention, however, all fifteen time slots ZS per transmission frame are spread using four codes C, so that a total of 60 transmission channels results. [According to the exemplary embodiment described, both] Both first base station 11 and second base station 12 may thus access 60 such

transmission channels if there is no interference, so that a total of 60 connections may theoretically be [carried out] established simultaneously within the geographical range defined by first radio cell 61 and by second radio cell 62, if the reservation of transmission channels for setting up a broadcast channel for each of the two base stations 11, 12 is not considered.

[A further] Another exemplary embodiment [is illustrated in] according to the present invention is described with reference to Figure 4. In this case, 310 identifies a radio coverage area, for example, a shared radio cell, in which a third base station 110 and a fourth base station 210 are operated independently and uncoordinatedly from one another [and uncoordinatedly]. In this [case] exemplary embodiment, TDD operation using a CDMA method is [to be assumed] described for exemplary purposes[, as described]. Telecommunications network 5 may [again, as described,] be implemented as a mobile radio network or as a cordless telephone network [in this case].

Third base station 110 and fourth base station 210 are locally positioned directly adjacent to one another [in this case] and only separated from one another by a wall 320, which does not, however, represent an obstruction for the radio frequencies used for transmission [and is to indicate], but rather indicates that both base stations 110, 210 are, for example, positioned in neighboring office rooms. Third base station 110 supplies a third mobile station 120 via a third connection 140 and a fourth mobile station 130 via a fourth connection 150. Third connection 140 and fourth connection 150 may represent radio connections in the TDD mode [in this example, as described. In this case, it is to be assumed for exemplary purposes that]. In an exemplary scenario, third connection 140 and fourth connection 150 together may require a data rate so high that all of the transmission channels of the TDD mode available are used. Fourth base station 210 [now] then wishes

to establish a fifth connection 240 to a fifth mobile station 220 in the TDD mode using the CDMA method. For this purpose, as in the exemplary embodiment [shown in] described with reference to Figure 3, all transmission channels available in radio coverage area 310, i.e., code/time slot combinations, are checked as to whether they are already occupied or have interference, which causes them to fall below the preselected value for connection quality. If so, the corresponding transmission channel is unusable[, otherwise]. If not, it is usable. [If] Fourth base station 210 recognizes whether all transmission channels in radio coverage area 310 are unusable [or] and/or whether the number of the usable transmission channels still available for fifth connection 240 is smaller than the number of transmission channels necessary for fifth connection 240[, fourth base station 210 recognizes this.].

[In order nonetheless to be able to establish] To permit fifth connection 240 to be established without producing unacceptable interference for already existing third connection 140 and already existing fourth connection 150, fourth base station 210 changes a scrambling code used jointly [by it and] with third base station 110.

[As a rule, one] One single scrambling code is used within a radio cell. All signals [which are] transmitted in the radio cell are scrambled using this scrambling code [in this case. In order that]. To prevent signals of different neighboring radio cells [do not mutually interfere, particularly] from mutually interfering with one another, for example, if [a] CDMA [method] is used, [they] the signals are scrambled using different scrambling codes, i.e., neighboring radio cells use different scrambling codes. The various scrambling codes are selected [in this case in such a way] so that they have the smallest possible cross correlation with one another for any desired mutual time shifts. The spreading of the signals within a radio cell is then performed [with the aid of] using

orthogonal codes, which are mutually uncorrelated due to the synchronous transmission.

[This] In another scenario, this concept is [now] abandoned in the case of insufficient transmission capacity [described], in that in radio coverage area 310, which is to represent a shared radio cell [in this example], a scrambling code is introduced for fourth base station 210 which is different from the scrambling code of third base station 110.

Subsequently, the search for and possible assignment of sufficient interference-free transmission channels for fifth connection 240 to be established are repeated in the way described [for the exemplary embodiment] above with reference to Figures 1 to 3, but using the new scrambling code.

This procedure is repeated until a sufficient number of sufficiently interference-free transmission channels have been found and assigned to fifth connection 240.

If enough sufficiently interference-free transmission channels are not found, a further scrambling code may be checked in the way described above and [also] used if necessary. This procedure may be repeated until an "unused" scrambling code having enough sufficiently interference-free transmission channels is found.

On the basis of the scenario described above, a sixth connection 250 [is now to] may be established in the TDD mode using the CDMA method from fourth base station 210 to a sixth mobile station 230, as [shown in] described with reference to Figure 4. In [this case] another exemplary scenario, fifth connection 240 [is to require] requires a data rate so high that insufficient transmission channels are available for sixth connection 250, even with scrambling using the new scrambling code because, for example, all transmission

channels having the new scrambling code are used by fifth connection 240. The new scrambling code is referred to [in the following] below as the first new scrambling code.

For sixth connection 250, fourth base station 210 may now introduce a second new scrambling code, which differs from the first new scrambling code and the original scrambling code [possibly used]used, for example, by fourth base station 210, all scrambling codes used [to have] having the characteristic [described] of low mutual cross correlation for any desired mutual time shift.

The search for and possible assignment of sufficient interference-free transmission channels for sixth connection 240 to be established are then performed again in the way described [for the exemplary embodiment shown in Figs.] above with respect to Figures 1 to 3, but using the second new scrambling code.

This procedure is also repeated until a sufficient number of sufficiently interference-free transmission channels [has been] is found and assigned to sixth connection 240.

If enough sufficiently interference-free transmission channels are not found, a further scrambling code may be checked and [possibly] used in the way described above. This procedure may be repeated until an "unused" scrambling code having enough sufficiently interference-free transmission channels is found.

For a connection to be established between one of base stations 110, 210 and one of mobile stations 120, 130, 220, 230, various scrambling codes may [also] be used if the data rate necessary for this connection and the available sufficiently interference-free transmission channels require [this] it.

Therefore, if [it is established in the uncoordinated operation described that] the connection quality of all or many transmission channels is, for example, [becoming worse] worsening due to interference[, the attempt may be made, as] from the uncoordinated operation described[, to reduce] above, the influence of interference may be reduced by substituting other scrambling codes.

In this case, the use of different scrambling codes may lead to the transmission capacity of locally delimited telecommunications network 5 in uncoordinated operation being many times greater than that in coordinated operation.

The search for previously unused scrambling codes may either be performed according to a fixed sequence or by random selection of a scrambling code [in each case].

Third base station 110, fourth base station 210, third mobile station 120, fourth mobile station 130, fifth mobile station 220, and sixth mobile station 230 are each to have the construction and the mode of operation described for user station 15 shown in Figure 1. [At the same time, means 10 for] Simultaneously, channel measurement arrangement 10 may produce the new scrambling code(s) and [carry out] perform appropriate scrambling of the transmission channels to be measured

The measurement and assignment of transmission channels scrambled [in this way], and therefore also the change of the scrambling code, may be performed [in this case] both in base stations 11, 12, 110, 210, for example, for the uplink transmission direction, and in mobile stations 21, 22, 120, 130, 220, 230, for example, for the downlink transmission direction.

The search for new scrambling codes may be performed permanently or as needed.

[Abstract]

ABSTRACT OF THE DISCLOSURE

A method of assigning transmission channels [(1)] in a telecommunications network [(5)] and a user station [(11, 12; 21, 22) are described] are provided, which facilitate an increase in the capacity of [the] a telecommunications network[(5)]. The telecommunications network [(5) includes] may include multiple base stations [(11, 12)] and mobile stations[(21, 22)], the transmission channels [(1)] being provided for transmitting signals between the base stations [(11, 12)] and the mobile stations[(21, 22)]. In uncoordinated operation of the base stations[(11, 12)], at least one of the transmission channels [(1)] is assigned for transmitting signals between one of the base stations [(11, 12)] and one of the mobile stations [(21, 22)] as a function of a channel measurement, in which the transmission power on all possible transmission channels [(1)] is measured, if the previously measured transmission power on this transmission channel [(31; 32)] is minimal.